

joint, the ball assemblies and the cage. Therefore, the claim 1 has been amended accordingly without deviating from the original scope of the invention.

*Actions to Claims Rejections – 35 USC § 112*

6. In response to the Claims Rejections in sections 9 and 10 of the Office Action Summary dated 5/3/2005, the amended claims are attached herein. The claims are amended so that the limitations in the dependent claims have sufficient antecedent basis.

*Objections to Claims Rejections – 35 USC § 102*

7. In response to the Claims Rejections in sections 11 and 12 of the Office Action Summary dated 5/3/2005, the rejection is objected because Goetz, US 367,387 cannot be considered a prior invention of Park, 10/728,862 for the following reasons:

- a. Goetz, US 367,387 is a castor that has nothing to do with the constant velocity joints. In other words, the castors have different objective and construction than the constant velocity joints.
- b. Conventional castors employ a vertical swivel whose axis is offset from the axis of rollers, whereas Goetz, US 367,387 has zero swivel axis offset. Instead, Goetz employs a gyrocompass-like two intersecting roller shafts to allow the castor roll to any direction. The axes of the two shafts C & F intersect to each other at 90 degrees. On the other hand, Park, 10/728,862 employ two shafts (roller shaft 24 and slide shaft 35) that are co-axially disposed.
- c. Goetz, US 367,387 does not allow the rollers to slide axially along the roller shaft, whereas Park, 10/728,862 not only allow the rollers 22, 23 to slide axially along the slide shaft 35 but also allow the whole assembly to slide radially along the cage web grooves 4i.
- d. Goetz, US 367,387 intended the two rollers to contact and roll onto a single object (flat floor), whereas Park, 10/728,862 designed the two rollers 22, 23 to contact two different parts (inner race and outer race).

*Objections to Claims Rejections – 35 USC § 103*

8. In response to the Claims Rejections in sections 13 and 14 of the Office Action Summary dated 5/3/2005, the rejection is objected because Park, 10/728,862 is not an obvious modification of Goetz, US 367,387 for the following reasons:

- a. Goetz, US 367,387 is a castor that has distinctively different objective and construction when compared to Park, 10/728,862 that is a constant velocity joint. Therefore, Goetz, US 367,387 cannot be used or compared against Park, 10/728,862.
- b. Goetz, US 367,387 have roller shafts C & F that are positively fixed to A & C respectively, whereas Park, 10/728,862 has the slide shaft 35 that can slide/float along the cage web grooves 4i and has the roller shaft 24 that can slide along the slide shaft 35. In other words, the small diameter ends of the slide shaft 35 are not a mere modification of the size/shape but a feature for mating with the cage web grooves 4i. The amended claims attached herein will solve this kind of minor technical issue.
- c. “The international search report” (dated 4/21/2005) by PTC (Patent Cooperation Treaty) and “the written opinion” of the International Search Authority for the international application of Park, 10/728,862 have concluded that all 12 claims of the invention meet the requirements of novelty, inventive step, and industrial applicability (refer to Fig. A).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY				International application No. PCT/IB2004/
<b>Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</b>				
1. Statement				
Novelty (N)	Claims	1-12		YES
	Claims			NO
Inventive step (IS)	Claims	1-12		YES
	Claims			NO
Industrial applicability (IA)	Claims	1-12		YES
	Claims			NO
2. Citations and explanations :				
The following documents identified in the International Search Report have been considered for the purpose of this report:				
D1: <u>US 4,950,206 (UNI-CARDAN AG)</u> 21 August 1990				
D2: <u>US 5,501,639 (GKN AUTOMOTIVE AG)</u> 26 March 1998				
D3: <u>JP 15-21158 (NTN CORPORATION)</u> 24 January 2003				
Claim 1 defines a multi-roller ball assembly for any type of constant velocity joints with torque transmitting balls comprising: a roller shaft (24) acting as a common shaft for a center roller (21) and a pair of half spherical rollers (22, 23) and having an axis hole (24d) for a sliding pin (25); a center roller (21) forming a ring-shaped sub-roller member; a pair of half spherical rollers (22, 23) which spin around the roller shaft (24); a sliding pin (25) positioned along the axis hole (24d) of the roller shaft allowing the roller shaft to slide along said sliding pin, either end of said sliding pin mating into cage web slots (4i).				
D1, D2 and D3 disclose constant velocity joints with torque transmitting balls, but <u>none of them disclose the multi-roller ball assembly comprising a roller shaft, a center roller, a pair of half spherical rollers, and a sliding pin; hence claim 1 is novel (Art. 33(2) PCT).</u>				
<u>The subject matter of claim 1 is not obvious in the light of any of these cited documents nor disclosed in any obvious combination; hence claim 1 involves an inventive step (Art. 33(3) PCT).</u>				
<u>Claims 2-4 and 6-12 meet the requirements of Article 33(2) and (3) PCT since claims 2-4 and 6-12 are dependent on claim 1.</u>				
Claim 5 defines the multi-roller ball assembly according to claim 1, wherein said center roller (21) is removed. None of the documents in the ISR disclose the multi-roller ball assembly comprising a roller shaft, a pair of half spherical rollers, and a sliding pin; hence <u>claim 5 is novel (Art. 33(2) PCT).</u>				
<u>The subject matter of claim 5 is not obvious in the light of any of these cited documents nor disclosed in any obvious combination; hence claim 5 involves an inventive step (Art. 33(3) PCT).</u>				
<u>Claims 1-12 meet the requirement of industrial applicability (Art. 33(4) PCT).</u>				

Form PCT/ISA/237 (Box No. V) (January 2004)

Fig. A: Written Opinion of the International Searching Authority

### *Objections to Conclusion*

9. In response to the Conclusion in section 15 of the Office Action Summary dated 5/3/2005, the conclusion is objected because Lehman, Pfaar, Kuttner, Matczak, Shannon, Maucher and IT-292730 are not pertinent to Park, 10/728,8627 for the following reasons:

- a. None of the references listed in "Conclusion" and "Notice of References Cited" are related to the ball-type constant velocity joints. Lehman, US 381,476 A is a castor. Kuttner, US 1,454,057 A is a bearing. Pfaar, US 3,441,299 A is a joint (rod end) for tie rod. Matczak, US 5,069,571 A is a rod end. Shannon, US 6,009,659 A is a fishing float. Maucher, US 6,227,978 B1 is a tripod joint. IT-292730 is about a spherical roller bearing.
- b. Tripod joints such as Maucher, US 6,227,978 B1 are categorized as near-constant velocity joints because they cannot produce true constant velocity characteristics. The inner member of the tripod joint has integral trunnions upon which rollers are disposed. Tripod joints do not employ solid balls, and their rollers are positively located by the trunnions, whereas the balls in any ball-type constant velocity joint should be properly positioned/steered by the inner race, outer race and the cage. Therefore, tripod joint is not relevant to the ball-type constant velocity joints such as Park, 10/728,8627.
- c. IT-292730 is about a spherical roller bearing. It is a well known industrial practice to split the rollers into two when the width (axial length) of the roller bearing is relatively larger than the diameter of the roller (see Fig. B). The crowned outer surfaces of the two split rollers of the IT-292730 do not form a single spherical surface. Therefore, there is no need for properly orienting the roller assembly. On the other hand, the two half spherical rollers in Park, 10/728,8627 form a single spherical surface, and therefore the roller assembly requires positive means for properly orienting the roller assembly. In addition, the small pin 5 in IT-292730 is an auxiliary part for centering the two split rollers. Therefore, it is not relevant to the roller shaft 24 and slide shaft 35 in Park, 10/728,8627.
- d. The referenced cited in "the international search report (dated 4/21/2005) by PTC for the international application of Park, 10/728,862" (see Fig. A) are good examples of relevant reference since all of them are about ball-type constant velocity joint.

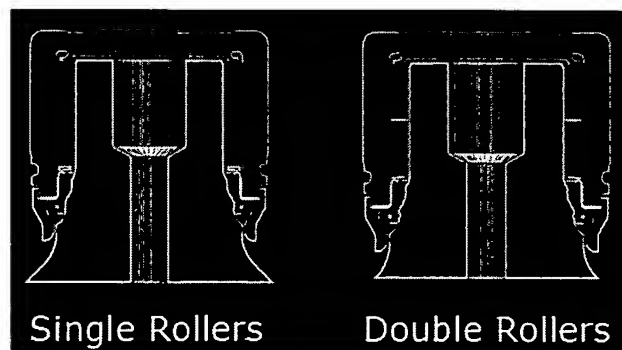


Fig. B: Universal joint trunnion bearing with single or double row rollers.

## Amendment Document

### *Remarks*

The amendment documents attached herein are a part of the response to the Office Action Summary dated 5/3/2005.

### *Substitute Specification*

Both the clean and marked-up versions of the substitute specification including abstract are attached herein. The amendment of the specification is mainly for limiting the scope of the invention to the elected species V. In other words, all contents or paragraphs relating to the non-elected species are either struck-out or withdrawn. In addition, some terminologies are rephrased to enhance the readability and to prevent any misunderstanding. For example, the “roller” is replaced by “sub-roller”, the “web slot” is replaced by “web groove”, and the “lug shaft” is replaced by “slide shaft”. The abstract has been amended to align it to the elected species V and to limit its number of words within 150.

### *Amended Claims*

The amended claims are attached herein. The claims are amended so that the limitations in the dependent claims have sufficient antecedent basis. Especially the claim 1 has been amended so that the relationships between the ball assemblies and the modified ball cage are clarified.

### *Amended Drawings*

The amended drawings are attached herein: The replacement sheets are attached after the amended specification, and the annotated marked-up drawings follow. Fig. 13 for the species V has been moved to Figs. 4 & 5. Fig. 5 is the species V with additional employment of the needle bearings. The ball assemblies in Figs. 8 & 9 have been replaced from the species I to the species V. Figs. 10 through 12 for the species other than V are canceled. Refer to the “brief description of drawings” in the amended specification for further details.

### *Table of Amended Documents*

The list of amended documents that follow this page is:

1. A listing of references
2. Substitute specification (clean version)
3. Substitute specification (marked-up version)
4. Amended claims
5. Drawings (replacement sheets)
6. Drawings (annotated marked-up version)

## CROSS-REFERENCE TO RELATED APPLICATIONS

### U.S. Patent Documents

U.S. Pat. No. 2,046,584 filed July 1924 by A. H. Rzeppa

U.S. Pat. No. 3,879,960, filed July 1975 by H. Welschhof et al

U.S. Pat. No. 2,322,570 filed June 1943 by A. Y. Dodge

U.S. Pat. No. 1,975,758 filed October 1934 by B. K. Stuber

### Other References

"Universal Joint and Driveshaft Design Manual," The Society of Automotive Engineers, Inc. 400 Commonwealth Drive, Warrendale, PA 15096, ISBN 0-89883-007-9, 1979.

Philip J. Mazziotti, "Dynamic Characteristics of Truck Driveline Systems," The Eleventh L. Ray Buckendale Lecture, SP 262, The Society of Automotive Engineers, Inc..

FIG. 4 (currently amended): species I is replace by species V

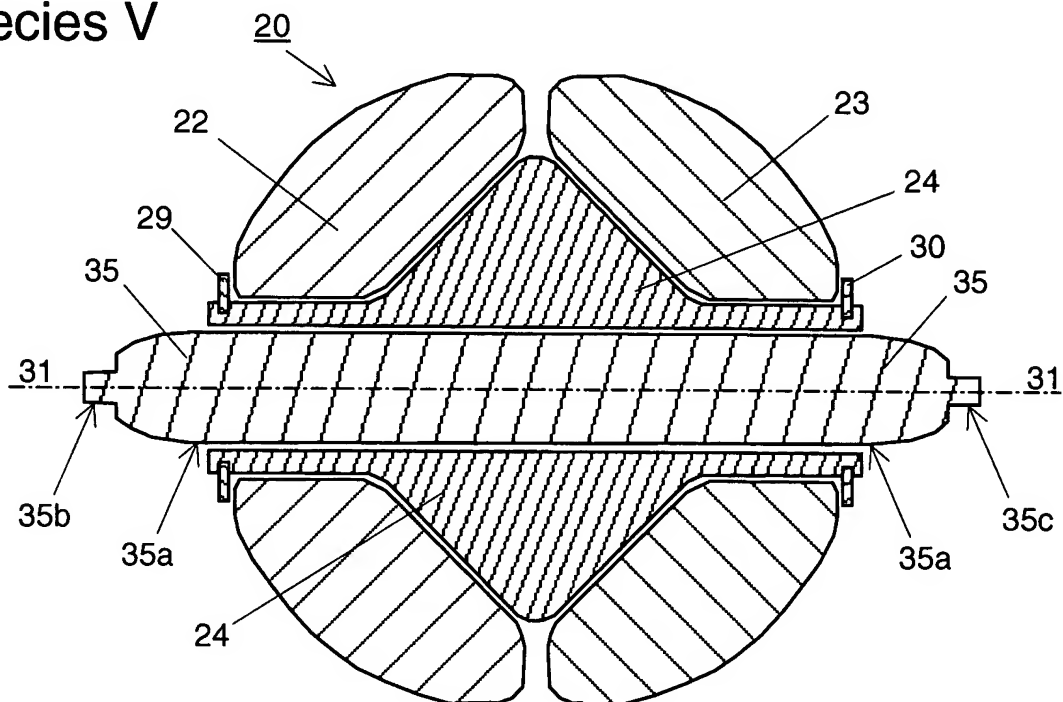


FIG. 5 (currently amended): species I is replace by species V with additional bearing elements

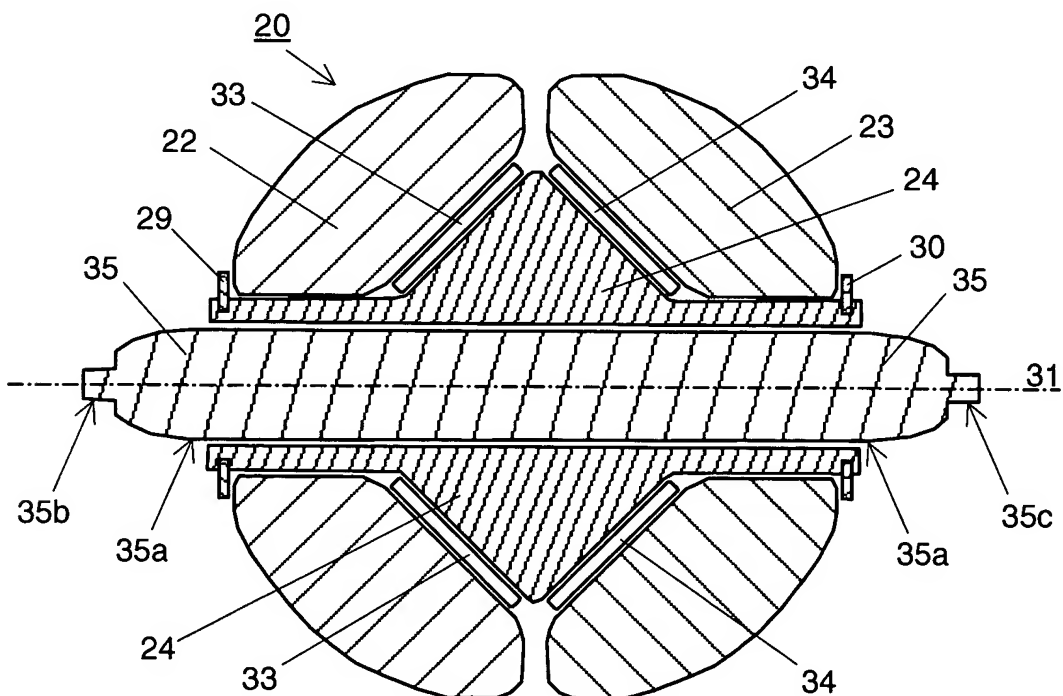




FIG. 8 (currently amended): The ball assembly of species I is replaced by species V.

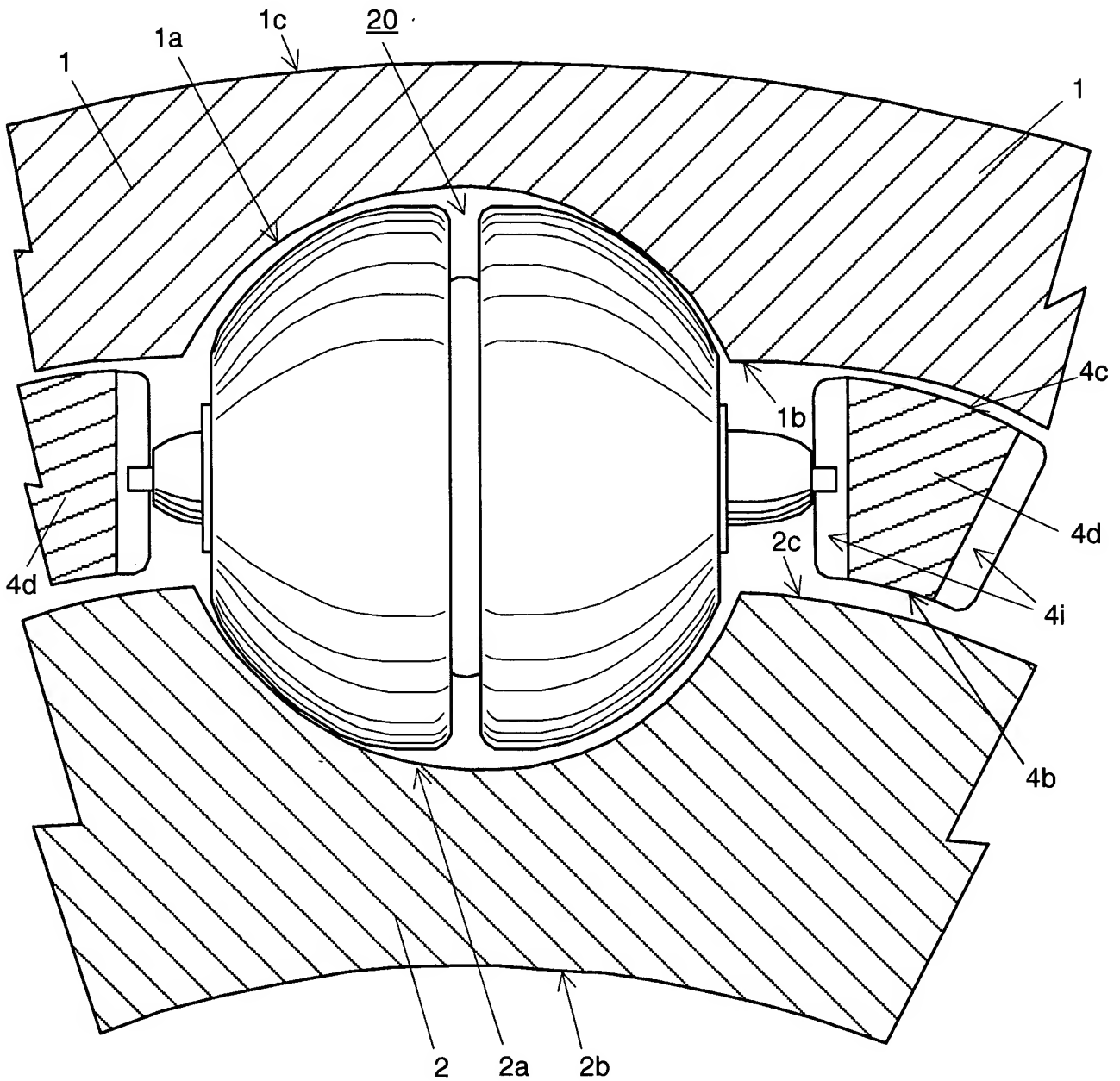


FIG. 9 (currently amended): The ball assembly of species I is replaced by species V.

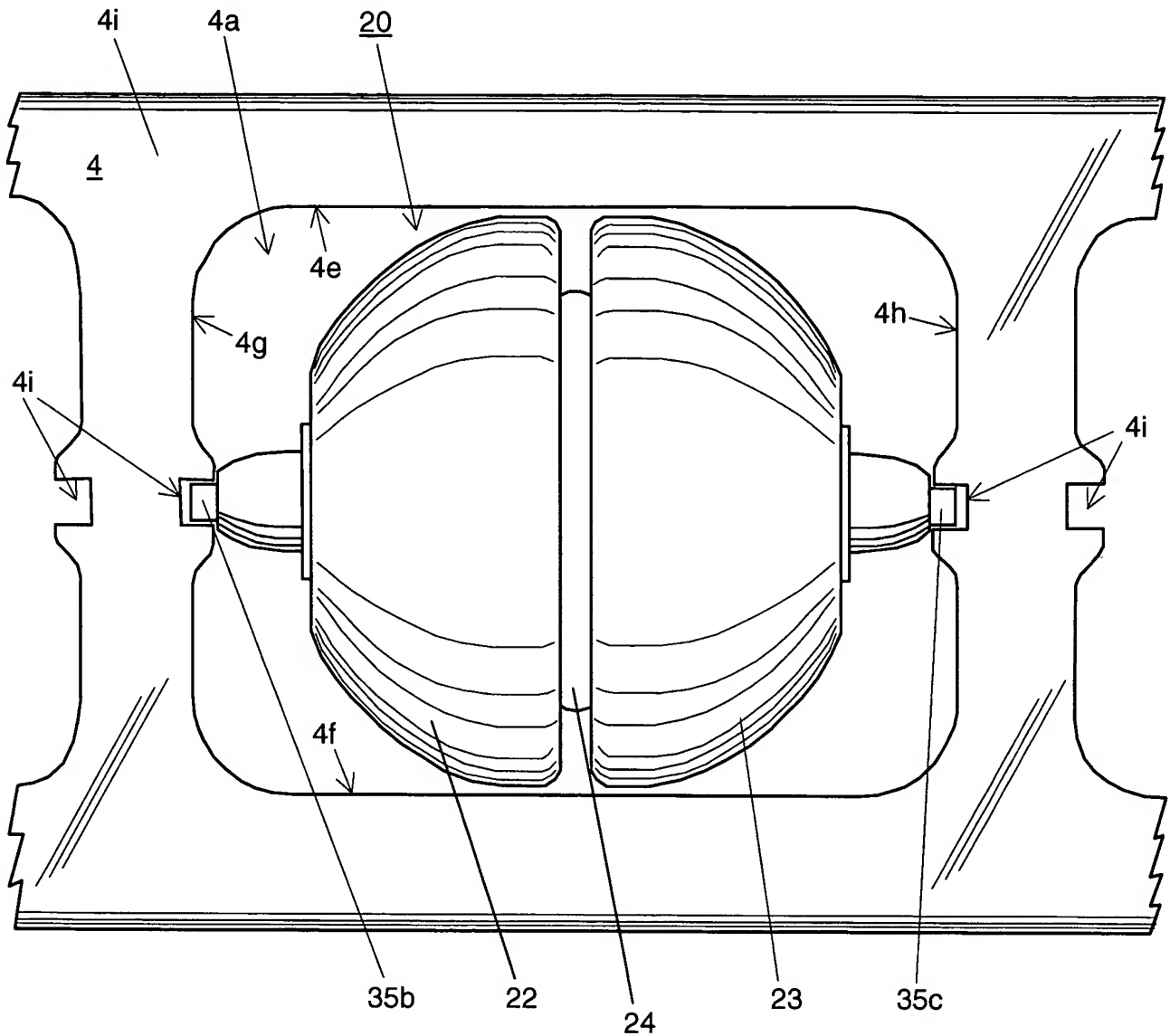


FIG. 10 (canceled): species II

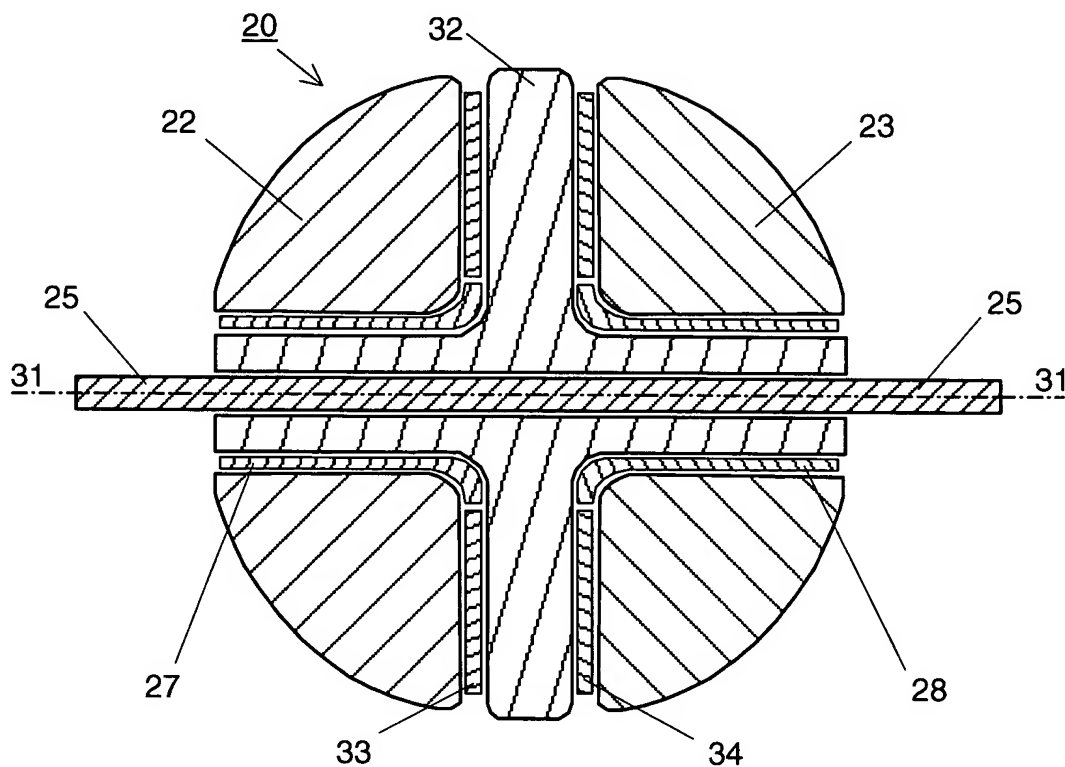


FIG. 11 (canceled): species III

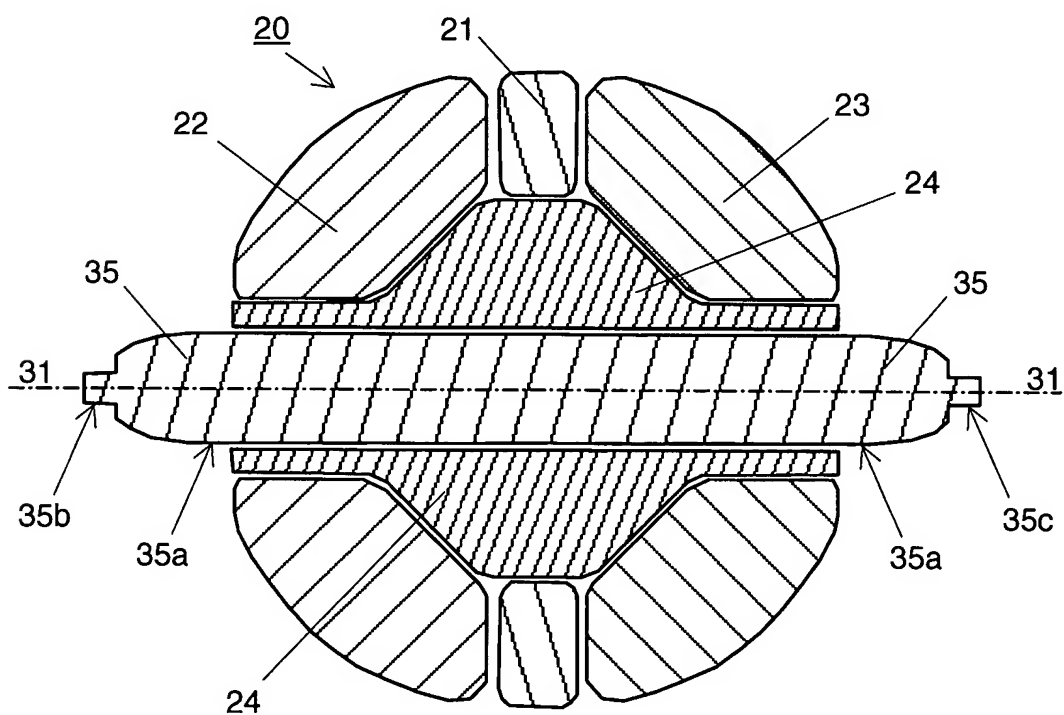


FIG. 12 (canceled): species IV

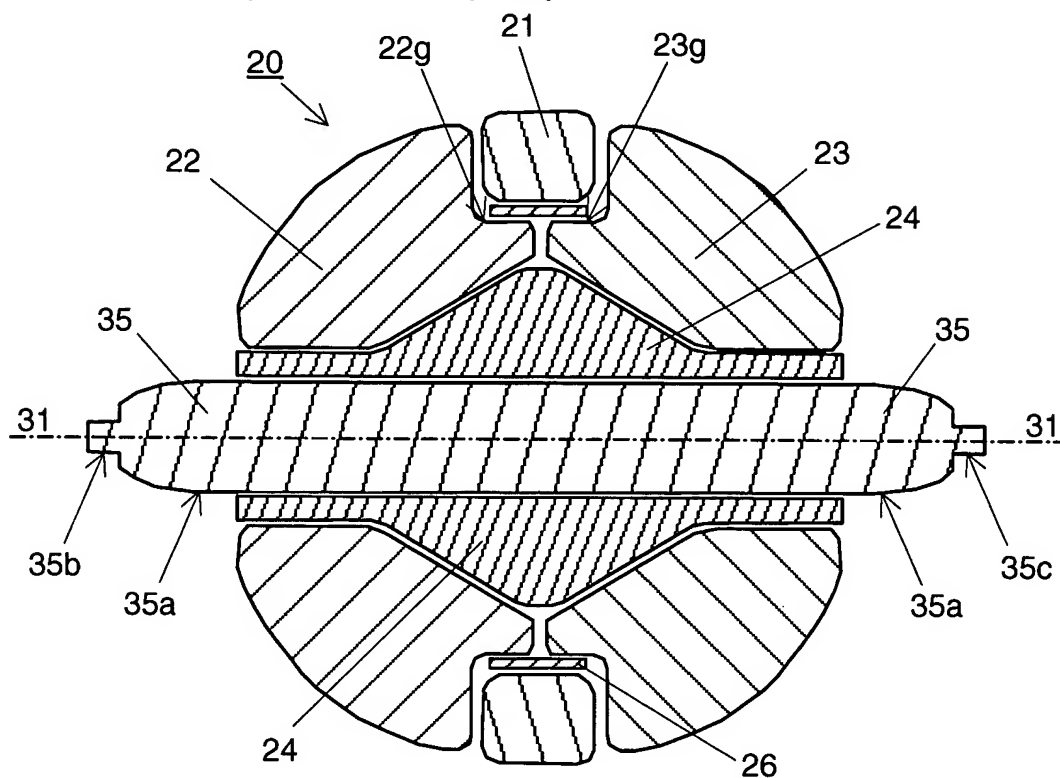


FIG. 13 (canceled): This drawing for species V has been moved to FIG. 4.

